

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No. : 10/566,431
Applicant : MASSELINK et al.
Filed : August 10, 2006
TC/A.U. : 2893
Examiner : Matthew L. Reames
Docket No. : 3367-101
Customer No. : 6449
Confirmation No.: 5759

DECLARATION UNDER 37 CFR §1.132

Dear Sir:

I, William Ted Masselink, declare as follows:

1. That I graduated from the University of Illinois Urbana-Champaign with a Ph.D. in Physics.

2. That I have been working in the field of III-V semiconductor heterostructure physics for 26 years and I am a professor of physics Humboldt University in Berlin, Germany. I also worked for 8 years as a research scientist at the IBM T.J. Watson Research Center.

3. I am one of the inventors of and am familiar with the subject matter described and claimed in the United States Patent Application Serial No. 10/566,431, filed on August 10, 2006, entitled "Quantum Well Structure", as well as the references cited by the Examiner.

4. That the claims of United States Patent Application Serial No. 10/566,431 are drawn to a quantum well structure for the absorption or emission of photons comprising a quantum well layer (7; 107; 207; 301) stacked between two barrier layers (9, 11; 109, 112; 209, 212; 303), wherein at least one of the barrier layers (9, 11; 109, 112; 209, 212; 303) comprises nanostructures (10; 110; 210; 310) arranged such that said nanostructures cancel or modulate a homogeneity of said quantum well layer extending in at least one lateral direction in the absence of said nanostructures, without substantially influencing energy values in said quantum well layers, wherein the quantum well layer (7; 107; 207; 301) is in the form of an absorption or emission layer for the absorption or emission of the photons, and wherein said at least one lateral direction extends perpendicularly to the stacking direction of said layers.

5. It is my expert opinion that, at the time of filing, one of skill in the art would know that if nanostructures, e.g. quantum dots, were present in a quantum well structure, and the nanostructures did not substantially influence the energy levels of the electrons in the quantum wells, then those nanostructures would have a larger bandgap than the band gap of the quantum wells.

6. That because the structure claimed in United States Patent Application Serial No. 10/566,431 requires that the nanostructures cancel or modulate a homogeneity of said quantum well layer extending in at least one lateral direction in the absence of said nanostructures, without substantially influencing energy values in said

quantum well layers, the claimed structure requires nanostructures with bandgaps that are higher than those of the quantum wells.


7. I have reviewed the Office Action dated April 29, 2009 and considered the Examiner's allegation that the structure disclosed in the United States Patent application 2003/0059998 (Holonyak) anticipates the presently claimed structure. I have reviewed the Holonyak disclosure and found that it relates to quantum well structures comprising quantum dots with bandgaps that are smaller than the bandgaps of the quantum wells.

8. It is my expert opinion that there is a fundamental difference between the structure of Holonyak and the structure claimed in United States Patent Application Serial No. 10/566,431 because Holonyak clearly states that the quantum dots are the lower bandgap part of the structure (paragraph [0008]) and also gives the example of the quantum dots being made from InAs, a material with lower bandgap than all others given in the example. Also, the conduction and valence band edges (that define the band gap) need to be smaller in energy because the carriers are supposed to end up in the quantum dots. Thus, the structure that Holonyak describes requires that the quantum dots have bandgaps smaller than the bandgaps of either the quantum well or of the barrier.

9. That the structure claimed in United States Patent Application Serial No. 10/566,431 is configured so the carriers are not collected in the nanostructures, but are

instead collected in the quantum well. The purpose of the nanostructures is to disturb the translational symmetry rather than as a low energy collection sink for the carriers as in Holonyak. Therefore, the nanostructures have conduction band edges higher in energy than the quantum well, but lower than the barrier. This energy position is necessary so that the carriers do not end up in the nanostructures, but stay in the quantum well. Therefore, the nanostructures do not substantially influence the energy values in the quantum well layers. By keeping the carriers in the quantum well, it is possible to better control the energy of the carriers. Energies in nanostructures are difficult to control because the nanostructures vary in size.

10. The undersigned further declares that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signature	 <u>William Ted Masselink</u>
Date	<u>22 July 2009</u>